WHAT IS CLAIMED IS:

1. A method of etching openings in a dielectric layer with profile control, comprising:

supporting a semiconductor substrate in a plasma etch reactor, the substrate including a dielectric layer;

supplying an etchant gas to the plasma etch reactor; and

etching openings in the dielectric layer by energizing the etchant gas into a plasma state, the etchant gas comprising $C_xF_yH_z$ wherein $x \geq 1$, $y \geq 1$ and $z \geq 0$, a sulfur-containing gas and an oxygen-containing gas, the sulfur-containing gas and the oxygen-containing gas being added in amounts effective for profile control of the etched openings.

2. The method of Claim 1, wherein the openings comprise vias, contacts, and/or trenches of a dual damascene, self-aligned contact or self-aligned trench structure.

3. The method of Claim 1, wherein the $C_xF_yH_z$ forms a protective sidewall polymer on sidewalls of the etched openings, the sulfur-containing gas protects the sidewall polymer from excessive attack by the oxygen-containing gas and the oxygen-containing gas maintains a desired thickness of the sidewall polymer.

4. The method of Claim 1, wherein the plasma etch reactor comprises an ECR plasma reactor, an inductively coupled plasma reactor, a capacitively coupled plasma reactor, a helicon plasma reactor or a magnetron plasma reactor.

5. The method of Claim 1, wherein the plasma etch reactor comprises a dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode, RF energy being supplied at two different frequencies to either the bottom electrode or at different first and second frequencies to the showerhead electrode and bottom electrode.

6. The method of Claim 1, wherein the sulfur-containing gas is SO_2 and the oxygen-containing gas is O_2, the SO_2 and O_2 being added in amounts effective to provide undissociated SO_2 molecules which react with polymer at bottoms of the etched openings to prevent etch stop under bombardment of directional ions.

7. The method of Claim 1, wherein the ratio of flow rates of the sulfur-containing gas to the oxygen-containing gas is 0.5:1 to 1.5:1.

8. The method of Claim 1, wherein pressure in the plasma etch reactor is 5 to 200 mTorr and/or temperature of the substrate support is -20°C to +80°C.

9. The method of Claim 1, wherein the plasma etch reactor is a capacitively coupled plasma reactor having a powered showerhead electrode and a powered bottom electrode, the showerhead electrode being supplied 500 to 3000 watts of RF energy and the bottom electrode being supplied 500 to 3000 watts of RF energy.

10. The method of Claim 1, wherein the etchant gas includes a carrier gas selected from the group consisting of He, Ne, Kr, Xe and Ar, the carrier gas being supplied to the plasma etch reactor at a flow rate of 5 to 1000 sccm.

11. The method of Claim 1, wherein the dielectric layer comprises a doped or undoped silicon dioxide, BPSG, BSG, FSG, PSG, TEOS, thermal silicon oxide or inorganic low-k material or organic low-k material, the dielectric layer overlying a conductive layer selected from the group consisting of Al, Al alloys, Cu, Cu alloys, Ti, Ti alloys, doped or undoped polycrystalline or single crystal silicon, TiN, TiW, Mo, silicides of Ti, W, Co and/or Mo or alloys thereof, the semiconductor substrate including an optional stop layer and/or mask layer selected from silicon nitride, silicon carbide or silicon oxynitride over the dielectric layer and/or between the dielectric and conductive layer.

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12. The method of Claim 1, wherein the sulfur-containing gas is SO_2 and the oxygen-containing gas is O_2, each of the SO_2 and O_2 gases being supplied to the plasma etch reactor at a flow rate of 1 to 30 sccm.

13. The method of Claim 1, wherein the dielectric layer is BPSG and the etchant gas includes SO_2 and O_2 supplied to the plasma etch reactor with flow rates providing a SO_2:O_2 flow rate ratio of 1:2 to 2:1.

14. The method of Claim 1, wherein the etched openings are 0.30 μm or smaller sized openings having substantially straight profiles wherein top, middle and bottom critical dimensions of the openings are substantially the same, and the openings have an aspect ratio of at least 5:1.

15. The method of Claim 1, wherein the dielectric layer includes a stack of layers of low-k materials with or without etch stop layers therebetween, the openings being etched to depths of at least 2 μm.

16. The method of Claim 1, wherein an RF bias is applied to the semiconductor substrate during the etching step.

17. The method of Claim 1, wherein the etched openings are 0.25 μm or smaller sized openings having substantially straight profiles wherein top, middle and bottom critical dimensions of the openings are substantially the same, and the openings have an aspect ratio of at least 10:1.

18. The method of Claim 1, wherein the etchant gas includes C_4F_8, SO_2, O_2 and Ar supplied to the plasma etch reactor at flow rates of 5 to 30 sccm C_4F_8, 2 to 15 sccm SO_2, 2 to 15 sccm O_2, and 300 to 600 sccm Ar.

19. The method of Claim 1, wherein the etchant gas includes C_4F_8, SO_2, O_2 and Ar supplied to the plasma etch reactor at flow rates of 10 to 20 sccm C_4F_8, 4 to 10 sccm SO_2, 4 to 10 sccm O_2, and 450 to 550 sccm Ar.

20. The method of Claim 1, wherein $C_xF_yH_z$ comprises at least one hydrogen-free fluorocarbon selected from CF_4, C_2F_2, C_2F_4, C_3F_6, C_4F_6, C_4F_8 and C_6F_6 and/or at least one hydrogen-containing fluorocarbon selected from C_2HF_5, CHF_3, CH_3F, $C_3H_2F_6$, $C_3H_2F_4$, C_3HF_5, C_3HF_7.